HARBIN ROPV INDUSTRY DEVELOPMENT CENTER

4 Inch High Pressure End Port FRP Pressure Vessel

User Manual

600~1200PSI

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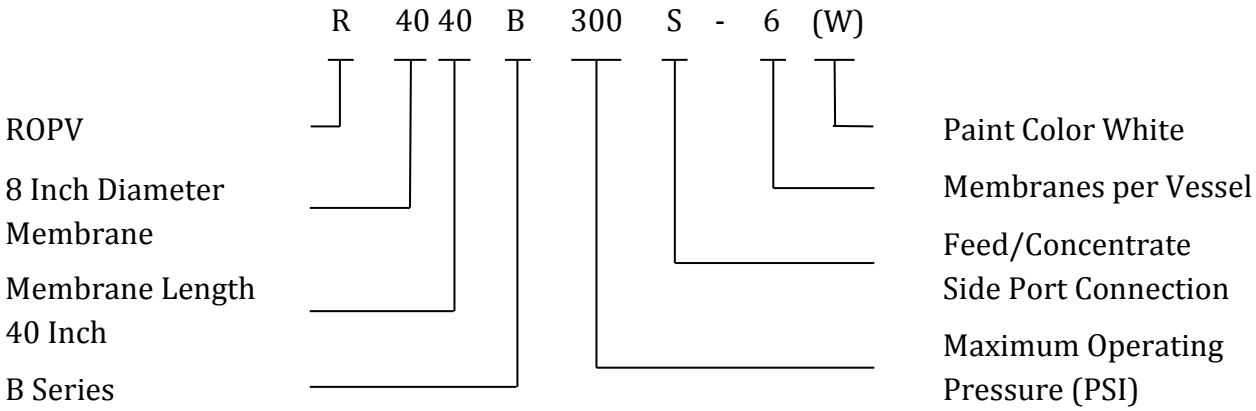
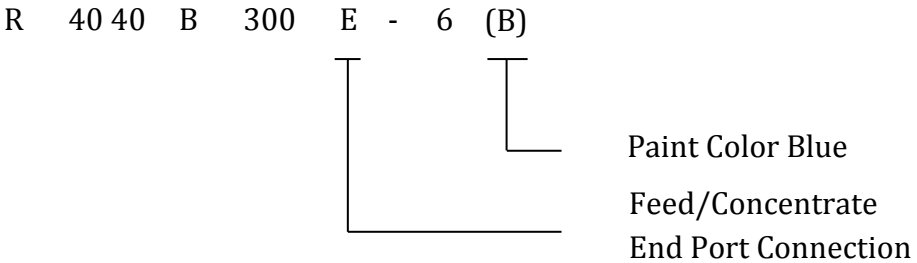
Chapter 1 General Product Description

ROPV pressure vessel is designed to withstand 6 times the designed pressure before a catastrophic failure occurs. As a safety precaution the housings are designed for a full body leak at 4 times the design pressure to keep catastrophic failure from happening. Each standard vessel is carefully inspected and a hydro-test is performed to ensure its reliability before delivering from the plant.

ROPV Pressure Vessels are designed to provide safe operation over a long service life if properly installed, operated, and maintained. The vessel may cause loss of life, severe bodily harm, or property damage if improperly installed, operated, or maintained. Read and understand all guidelines provided in the vessel User Manual. Observe every precaution contained therein. Failure to do so may result in malfunction and potential catastrophic failure. It is recommended that only qualified technicians experienced in servicing hydraulic systems work with this vessel. Misuse, incorrect assembly, or use of damaged/corroded components may result in catastrophic failure. ROPV Pressure Vessels are design and manufacture in accordance with the American Society of Mechanical Engineers, ASME, Section X Boiler and Pressure vessels Code requirements, for use as a membrane element housing.

Product Identification





Operation Specifications

R40 600E Design Pressure:	600 PSI / 4.1Mpa / 41 Bar
R40 1000E Design Pressure:	1000PSI / 6.9Mpa / 69 Bar
R40 1200E Design Pressure:	1200PSI / 8.3Mpa / 83 Bar Max. Max.
Permeate Pressure:	125PSI / 0.86Mpa / 8.6 Bar
Min. Operating Temp.:	14^0F / -10^0C
Max. Operating Temp.:	150^0F / 66^0C
Factory Test Pressure:	ASME: 1.1x Design Pressure
	Standard: 1.5x Design Pressure
Operating pH Range:	3 – 11
Cleaning pH Range:	2 – 12 (less than 30 minutes)

Vessel Use and Precautions

- Do not allow the vessel to fall or impact on the ground or other object.
- Use padding to protect the vessels during handling to prevent damage.
- Pressure up to the design pressure (PSI) of the specific model being used.
- Vacuum conditions should be avoided with vacuum breakers.
- Accommodates standard 8” nominal diameter spiral-wound elements.
- Read and follow the membrane manufacturer installation instructions along with this manual.
- The required vessel/element interface hardware is supplied with the vessel. Ensure that an element adapter is installed at each end of the vessel before use.
- Vessel expands under pressure and careful consideration must be taken when installing straps/saddles and system connection piping.
- Installation with the straps/saddles provided is strongly recommended
- Vessel should not support any other system components. Connections must be non-load bearing.
- Mount vessel using strap/saddle hardware provided and span recommended in the engineering drawing.
- Do not over tighten the straps – vessel must be allowed to expand under operation.
- Maximize the connection flexibility to allow for vessel growth under pressure.
- Align the side ports with the system manifold, correcting any misalignment before final installation.
- Provide overpressure protection in the system safety devices.
- Inspect end closures regularly for signs of corrosion. Immediate corrective action and/or replacement are suggested in case of corrosion.
- Relieve system pressure before working on the vessel.

- Do not attempt to over-tighten the Permeate Port connections as this may damage the end closure. One turn past hand tight should be sufficient.
- Never operate the vessel in excess of its ratings. This may void the warranty and cause bodily or property damage.
- Do not operate the vessel permeate port over 125PSI.
- Flush the vessel with permeate before system shutdown to reduce the chance of corrosion.
- Do not install the vessel under direct sunlight.
- Operate the vessel within the recommended pH range - Operating pH Range: 3 – 10, Cleaning pH Range: 2 – 12 (less than 30 minutes).
- Minimize membrane movement by careful shimming the membrane column.
- Failure to understand and follow all precautions may void warranty and result in catastrophic failure of the vessel.
- These guidelines are subject to change. Please check with ROPV to ensure that the User Manual is the latest version for the vessel model being used.

Chapter 2 Installation

2.1. Carefully study the vessel engineering drawings for key dimensions and technical requirements.

2.2. Design and manufacture rack according to engineering drawings and system capacity. Independent support of both pressure vessel and manifolds shall be considered in the design of the rack.

2.3. Check the integrity of the vessel, especially the inner surface of the vessel and the sealing surface of the Feed/Concentrate ports.

2.4. Ensure enough space is reserved around the two ends of the vessel for installation and removal of the membrane elements.

NOTE: Install the vessels centered on the rack to avoid stress concentration on the Feed/Concentrate ports.

2.5. Mount the vessel on the provided saddles at the recommended span positions shown on the engineering drawings.

2.6. Connect the vessel to the manifolds and/or to the next vessel while adjusting each vessel and manifold to minimize misalignment at each end. (For details, see “Chapter 4 Piping Connections”).

2.7. Install the strap assembly. Install the screws through the hole in the rack and thread them into the strap locknut; use a torque wrench to tighten the screws within 3~5N.m.
NOTE: Pressure vessels expand during pressurization, over tightening the strap assemblies will damage the vessel.

2.8. Assemble end closure(For details, see “Head Assembly” in “Maintenance Guide”)

2.9. Install membrane elements(For details, see “Membrane Elements Installation” in “Maintenance Guide”)

2.10. Close the vessel.

2.11. Connect the permeate port manifolds (For details, see “Piping Connections”)

2.12. Inspect the installation. Inspection includes but is not limited to the position of the vessel, the end caps and pipelines connections. Please inspect according to “Pre-Pressurizing Checking list” in Appendix 1.

2.13. Pressurize and run the system.

If in doubt or for installation issues, please contact ROPV.

Chapter 3 Piping Connections

Enough room shall be reserved for both axial and radial expansion of the vessel in the design of the manifolds and pipelines; otherwise the vessel and other components of the system could be damaged. There are some location deviation about feed\concentrate ports and permeate ports connecting, consider these deviation when design the piping connection, otherwise the stress concentration may damage the pipe. Careful reading of this chapter will facilitate safe and normal working conditions of the vessel and pipelines.

3.1. Permeate Port Connections

3.1.1. Use flexible connections to reduce vibration impact.

3.1.2. A U swan-neck tubing with flexible connectors at both ends, or one piece of flexible soft pipe should be used for permeate port connections.

3.1.3. Extra and independent support shall be provided for permeate port pipelines rather than using permeate port as support.

Note: To prevent damage to the permeate port do not tighten the permeate port connections over 50N.m of torque.

3.2. Feed/Concentrate Port Connections

3.2.1. Use flexible grooved couplings (IPS).

3.2.2. Do not connect any manifolds rigidly to the vessel.

3.2.3. Manifolds must be supported independently.

3.2.4. Manifold span should be greater than vessel span to allow for vessel growth under pressure.

3.2.5. To reduce the risk of stress concentration we recommend that “two IPS standard flexible couplings and one piping section” are used to connect the Feed/Concentrate ports and manifold ports; this method lowers requirements for housing alignment and the position accuracy of the manifold welds. However, this method will increase the initial cost as shown in figure 1.1.

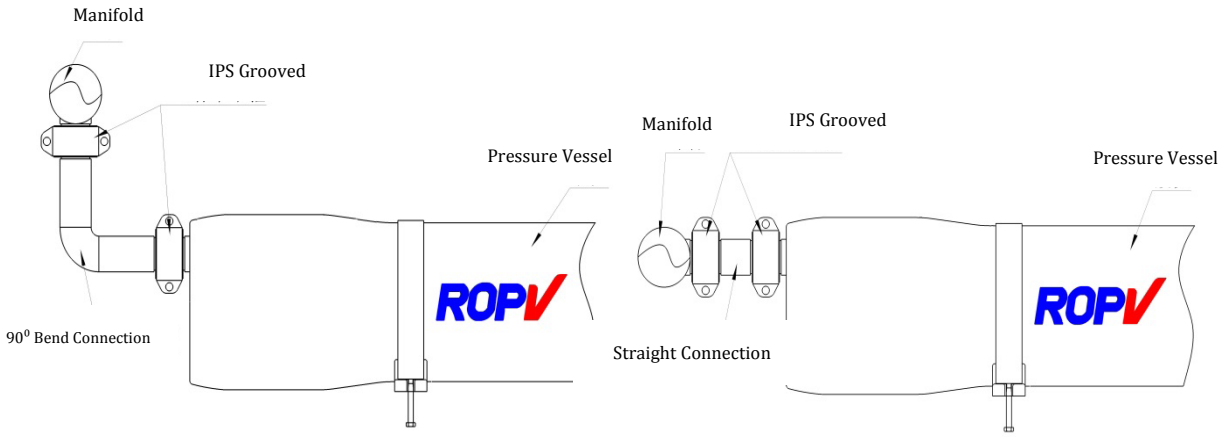


Figure 1.1

3.2.6. The use of only one IPS standard coupling to connect directly to the manifolds is also acceptable. However, the welding of the manifolds and the installation position of the housing should be accurately controlled to ensure the proper alignment of the manifold and the Feed/Concentrate ports.

3.2.7. Install the vessel correctly: Make sure to align the Feed/Concentrate ports and the manifold ports at a distance of 3.17mm.

3.2.8. Connecting the vessel and the manifold: Since only one IPS coupling is used to connect directly to the manifold precautions shall be taken to ensure additional flexible space is provided for the connection of vessels and manifolds by adding an extra IPS coupling to the manifold, as shown in figure 1.2.

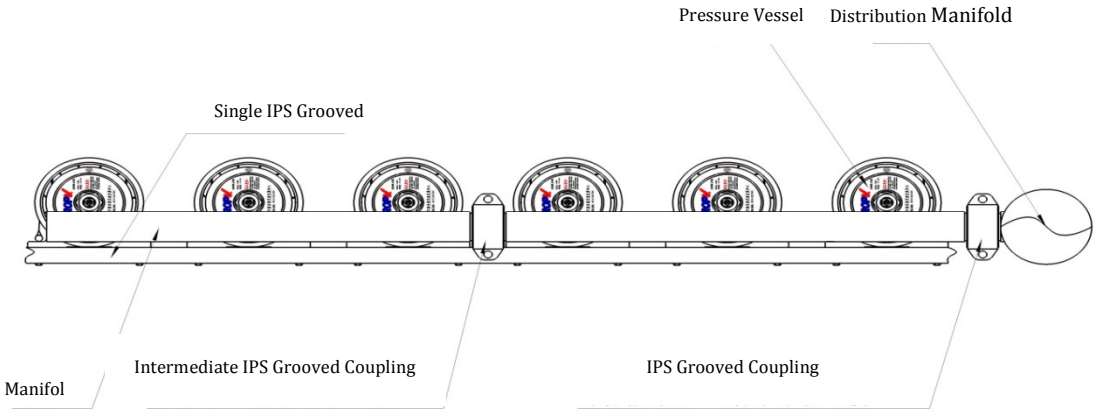


Figure 1.2

3.2.9. Slight angle between manifolds and F/C ports using IPS standard clamp for connection is acceptable. However, high accuracy in alignment is required. Misalignment in any direction should be avoided and keep to a minimum as much possible since it will generate mechanical stress concentrations that will damage the membrane housing.

3.2.10. Verify the alignment: There is a maximum of 0.76mm misalignment tolerance in any direction for all ports as shown in figure 1.3. Severe misalignment could impair the life expectancy of the vessel. Excessive force to tighten the couplings is an indication of misalignment. When properly aligned couplings should be able to turn slightly by hand after installation.

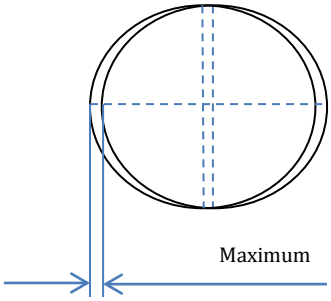


Figure 1.3

Chapter 4 Maintenance Guide

WARNING

Read this section completely before servicing the vessel.

DO NOT Service any component until you verify that system pressure is fully relieved from the vessel and the system is completely shut down.

4.1. Preventive Maintenance

Periodical cleaning and maintenance of the vessel and replacement of damaged components is essential to ensure a safe and normal operation of the vessel over a long service life.
As a recommendation we suggest to follow the Prevention Checklist below:

End closures.

- Periodically clean and remove any salt and/or corrosion deposits.
- Inspect components for deterioration and replace as needed.
- Maintain external components dry and leak free.

Side Ports.

- Inspect for leakage.
- Inspect coupling connections for corrosion and replace deteriorated couplings as needed.
- Maintain all side ports dry and leak free to prevent corrosion.

4.2. Opening the Vessel

4.2.1. **Shut Down System and Relieve System Pressure** – The system must be shut down and all pressure relieved before conducting any maintenance or repair on the vessel. Read and follow all related guides provided by system provider.

4.2.2. **Disconnect permeate port piping**. Unscrew and remove the permeate port piping using a wrench. Pay attention to the thread-turning direction to prevent any damage to the permeate port due to reversed turning or over-turning.

4.2.3. **Inspect End Closure** – The end closure should be inspected for any signs of corrosion or damage. Surface corrosion and salt deposits can be removed with a brush or scrubbing pad, while flushing with water. Damaged components should be replaced with approved components from ROPV.

4.2.4. **Remove the Head Assembly -** Remove the locking kit segment screws using a hex wrench.

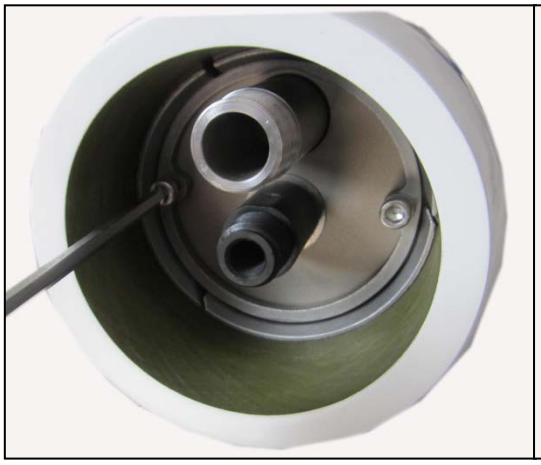


Figure 2.1 Removing screws

Figure 2.2 Removing locking segments

4.2.4.1. Lift the locking kit segment out of the retaining groove using a screw driver. Should the assemblies be difficult to remove, it may be necessary to rock the head slightly or tap the head inward with a rubber mallet. Remove the end closure. It is recommended to use dedicated end closure removal tools from ROPV.

4.2.4.2. **ROPV Head Removal Tool**– A head removal tool set is available from ROPV. While not necessary for head removal, they have proven an effective and easy way to remove the vessel head without causing any damage to the vessel.

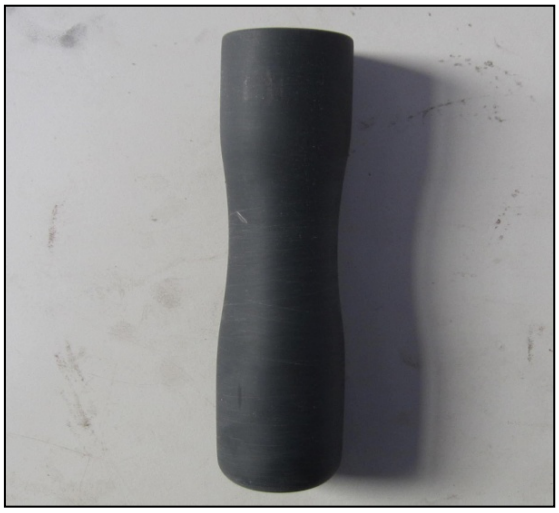


Figure 2.3 ROPV Head Removal Tool

4.2.4.3. Thread the tool piece into the permeate port of the head assembly, to hand tight. Do not over tighten the center piece (Fig. 2.4).

Figure 2.4

Figure 2.5

4.2.4.4. Pull the tool outward to remove the head. If the vessel has been in operation for an extended time, a slight rocking motion or forceful tug may be required to break the head seal bond.

4.3. Head Disassembling.

Read this article carefully before disassembling the head assembly to prevent damaging its components.

NOTE

Carefully remove the seals to prevent damage to the sealing surfaces. It is recommended to replace all used seals with brand new seals.

4.3.1. **Inspection**: Make sure that the end cap is removed from the vessel according to <Opening the Vessel>

4.3.2. **Remove the adaptor and seals:** Hold the bearing plate tightly with one hand

Figure 2.6 Remove adaptor and seals

and pull the adaptor out of the permeate port with the other hand; remove the permeate port seal, adaptor seal and the end cap seal.

4.3.3. Remove the perm port retaining ring using appropriate pliers.

Figure 2.7 Remove retaining ring

Figure 2.8 Remove bearing plate

4.3.4.Separate the bearing plate and sealing plate.

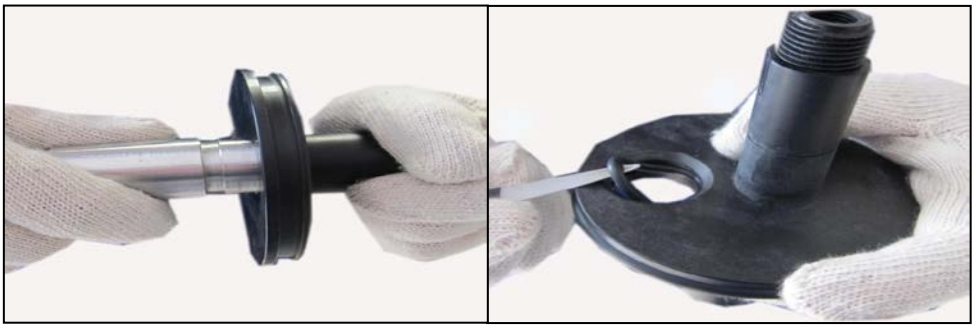


Figure 2.9 Remove sealing plate plug and seal.

4.3.5.Remove the feed/concentrate locking segments, port, and seal from the sealing plate.

Figure 2.10 Head breakdown

Components：Bearing plate, sealing plate/perm port, seal plate plug, permeate port plug, retaining ring, seals

4.4. Head Assembly Cleaning and Inspection.

Please read this section carefully before making decisions and taking measures on component structure or corrosion problems. Please combine the operational experience with this manual to deal with corrosion and component damage. You can refer to <Breakdowns and solutions> for the content that is not included in this section or contact ROPV for conditions not covered in this manual.

4.4.1. **Cleaning and Inspection of the metallic components.**Metallic components include, stainless steel locking kit segments and screws.

4.4.1.1 Inspect the components for scale, salt deposit or corrosion, use a steel brush or a scrubbing pad to loosen any deposit. Be careful not to scratch the bearing plate anodize coating.

4.4.1.2 Place the components into a vessel filled with mild soap solution and remove the corrosion.

4.4.1.3 Flush all components with clean water.

4.4.1.4 Dry the components with compressed air or a clean and dry towel.

4.4.1.5 Inspect all components carefully, check for any structural defects or damage in the bearing plate anodized coating. Replace any damaged or defective component.

4.4.2. **Cleaning and Inspection of the non-metallic components**. Non-metallic components include end cap, adaptor, permeate port plug and all seals.

4.4.2.1. Inspect components for scale, corrosion or salt deposit.

4.4.2.2. Place the components into a bucket filled with mild soap solution and clean them to remove the deposits.

4.4.2.3. Flush all components with clean water.

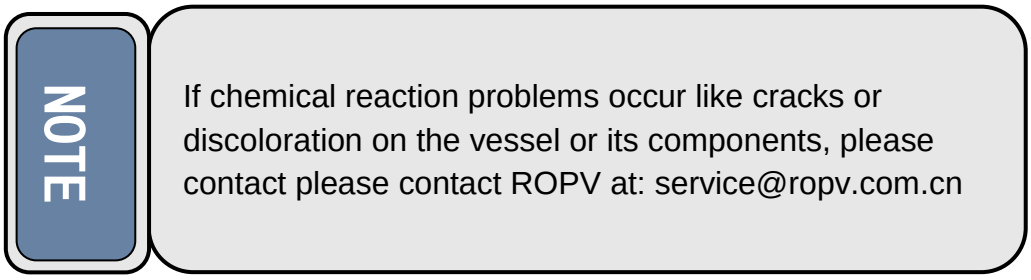
4.4.2.4. Dry the components with compressed air or a clean and dry towel.

4.4.3. Inspect all components carefully for any structural defects or damage in the seals. For example, cracks in the permeate port or the locknut, damage in the threads; aged, deformed or damaged seals. Replace any damaged or defective component with new ones

4.4.4. Replace all components that need to be changed upon inspection

4.4.5. Inspect carefully the Feed/Concentrate ports and attachments to the shell to ensure that connections and seals are structurally sound. Please contact ROPV for any questions.

Please do not conduct any repair work before consulting with the manufacturer for guidance, except for replacing head components.


NOTE
If chemical reaction problems occur like cracks or discoloration on the vessel or its components, please contact please contact ROPV at: service@ropv.com.cn

4.5. **Head Assembly.**

Read and follow this section. Incorrect assembly may result in catastrophic head failure.

ATTENTION

We recommend using brand new seals for head assembly.
Lubricate seals using glycerin or silicone base lubricant.

4.5.1. **Lubricate and install the seals.**

4.5.1.1. Lubricate the permeate port seal and the feed/concentrate seal and place them in the grooves.

Figure 2.11 Install the permeate port and feed concentrate port seals

4.5.1.2. Lubricate the adaptor seals and place them in the grooves of the adaptor.

Figure 2.12 Adaptor seals installation

4.5.2. **Assemble the sealing plate and bearing plate.**

4.5.2.1. Install the feed/concentrate port onto the sealing plate, then install the moon shape locking degments on to the grooves of the feed/concentrate port (See Fig, 2.13).

Figure 2.13 Feed/concentrate port installation.

4.5.2.2. Slide the bearing plate over the perm port and feed/consentrate port until it makes full contact withthe seaingl plate.

4.5.2.3. Install the retaining ring onto the groove of the permeate port to secure the bearing plate to the sealing plate.

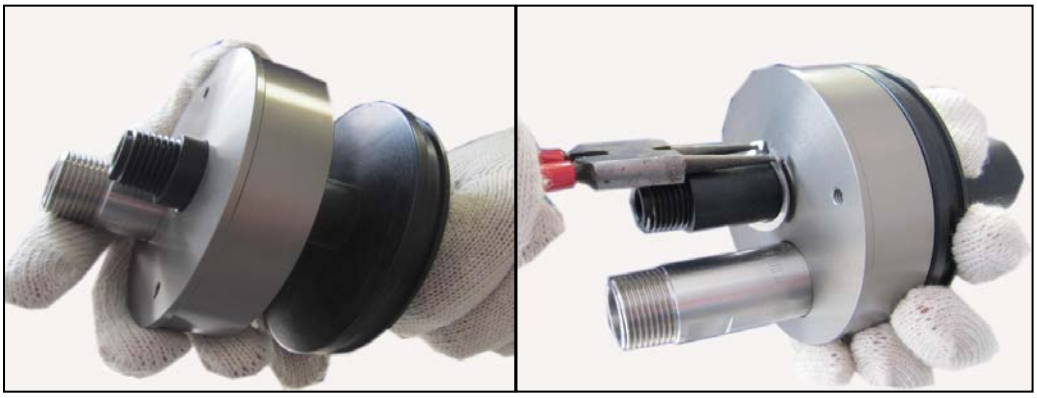


Figure 2.14 Bearing plate instalation

4.5.3. **Install the adaptor**. Insert the end without seals into the hole of the permeate port.

Figure 2.15 Adaptor installation

4.5.4. **Install the head O-ring.** Lubricate the O-ring and seat it into the groove located on the outside diameter of the End cap.

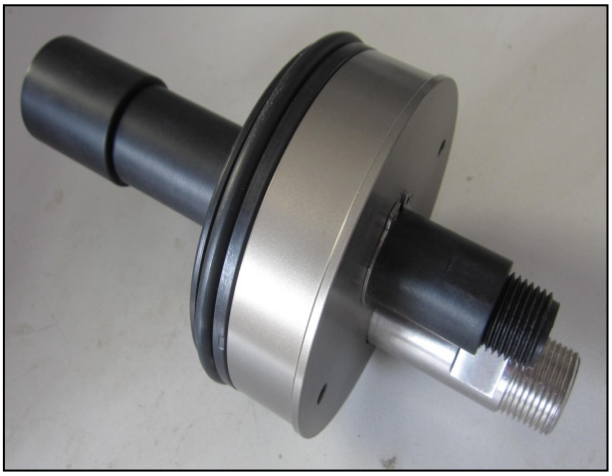


Figure 2.16 End cap assembly

Chapter 5 Loading/Replacing Membrane Elements

Read all parts of this section before replacing membrane elements. This article is for reference only; load/unload the membrane elements according to the membrane manufacturer requirements.

Membrane elements must be loaded at the feed (upstream) end of the vessel, and unloaded through the concentrated (downstream) side of the vessel. Always remove and install elements in the direction of feed flow.

Make a matching list for the removed membrane and the vessel to avoid possible disorder during membrane loading

Steps:

5.1. Inspection

5.1.1. Verify all pressure has been relieved from the vessel, following system manufacturer's recommendations.

5.1.2. Ensure the vessel is opened according to **Opening the Vessel.**

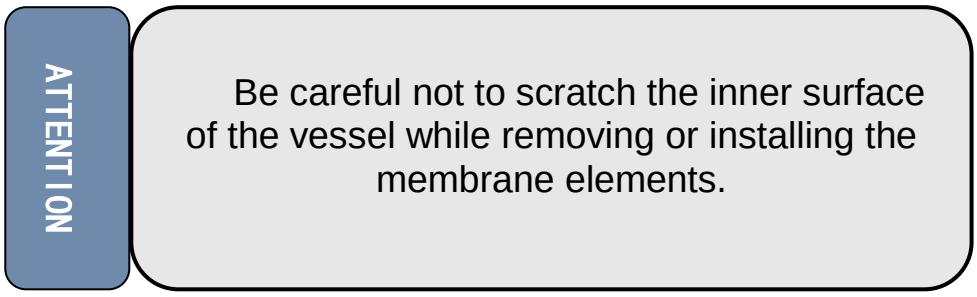
5.2. Disassemble membrane components

5.2.1. Remove the adapter from the membranes on both sides of the vessel.

5.3. Unload the membrane

5.3.1. Clean off any lubricant residue or salt build up from the inside diameter at both ends of the vessel.

5.3.2. Remove the membrane out of the vessel according to the membrane manufacturer requirements.


ATTENTION
Be careful not to scratch the inner surface of the vessel while removing or installing the membrane elements.

5.4. Check and make sure the head is assembled according to Head Disassembly and Head Assembly.

5.5. Vessel cleaning and inspection

5.5.1. Clean the inner surface and groove of the vessel by removing the residue or corrosions with a mild soap solution and then flush with clean water.

5.5.2. Check if there is any damage to the inner surface of the vessel. If yes, Please change the vessel.

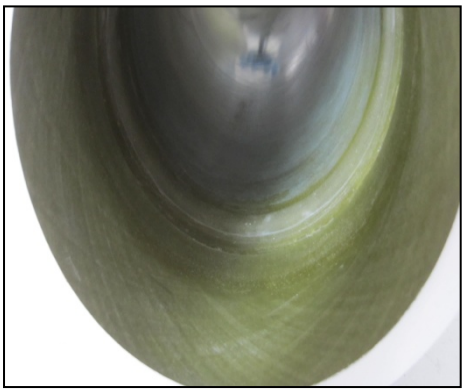


Figure 2.17 Inspecting the vessel

5.6. Install the end cap at the concentration side

5.6.1. Apply a thin layer of glycerin within 50mm from the groove on the inner surface of the vessel at the concentrate (downstream) end of the vessel.

5.6.2. Apply a thin layer of glycerin on the surface of the head O-ring for the concentrate (downstream) end of the vessel.

5.6.3. Hold the end cap and the vessel in the same axis and push the end cap into the vessel until some resistance can be felt. Then continue pushing the head slowly into the vessel until it reaches over the groove. Please do not push the head too much over the groove since the seals may be damaged if the head needs to be pulled back. If it is difficult to push the head with hands, a rubber mallet can be used to tap the head until the head reaches its place.

5.7. Install locking kit segment at concentration side.

5.7.1. Inspect the groove and ensure it is clean and free of residues. Use compressed air to dry the groove if available or use a clean rag to dry it.

5.7.2. Apply lubricant like glycerin onto the locking kit segment screws to prevent salt deposits to buildup.

Figure 2.18 Install locking kit segment

5.7.3.Position the locking kit segments into the groove.

5.7.4.Install the retaining ring and screws. Tighten the screws up to 10Nm of torque.

Figure 2.19 Install retaining ring and screws

5.8. Load membrane elements from the feed end of the vessel

5.8.1.Inspect and confirm there are no scratches on the inner surface of the vessel**.**

5.8.2.Inspect and ensure there is nothing on the outer surface of the membrane that may scratch the inner surface of the vessel**.**

5.8.3.Using a clean rag or cotton and a mixture of glycerin and clean water at a 1:1 ratio ball lubricate the inner surface of the vessel.

5.8.4.Using a clean rag or cotton and a mixture of glycerin and clean water at a 1:1 ratio ball lubricate the membrane seal.

5.8.5.Load the membrane from the feed end of the vessel; ensure that the membrane is properly orientated. If there are more than one membrane to be loaded into the vessel, do not push the first membrane into the vessel completely but reserve around 200mm to facilitate the connection of the next membrane.

5.8.6.Inspect and make sure the membrane interconnector is clean and intact. Apply a thin layer of glycerin onto the interconnector seals without excessive amount; otherwise the membrane may get contaminated. Install the interconnector into the loaded membrane.

5.8.7.Install and connect the next membrane with the loaded one with the interconnector.

ATENTION

Please ensure all membranes are in the same axis. No load on the connection pipe, otherwise the pipe or the membrane may be damaged.

5.8.8. Load all membrane elements in the same way. Push all the membranes into the vessel until the adaptor at the concentration end is inserted into the center hole of the first membrane and the membrane face is pushed against the perm port of the concentrate side end cap.

Chapter 6 Closing the Vessel

Please read this article carefully. Incorrect assembly may result in catastrophic failure.

Warning

Please read this article before closing the vessel. DO NOT use corroded or damaged parts to avoid catastrophic failure. Do not pressurize the vessel before all closing steps are finished.

6.1. Pre-Closing Inspection

6.1.1. Inspect the head is assembled as per **Head Disassembly and Head Assembly**

6.1.2. Verify that the membranes are loaded as per **Loading/Replacing Membrane Elements**

6.1.3. Ensure the inner surface of the vessel is free of corrosion build up or residue of foreign materials.

6.1.4. Inspect and make sure there are no scratches or damage on the inner surface of the vessel.

6.1.5. Inspect the vessel groove and make sure there are no residues or salt buildup in it.

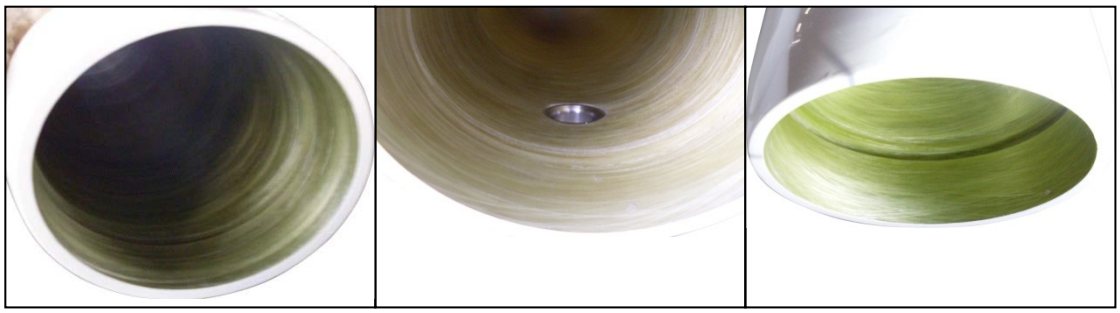


Figure 2.20 Vessel cleaning

6.1.6. Inspect the Feed/Concentrate port connections and vessel, make sure the threads are intact, structurally sound and free of corrosion. If you have any questions or find any adverse situation please contact ROPV.

6.2. Install head at the feed end (upstream)

6.2.1. Apply a thin layer of glycerin within 50mm from the groove on the inner surface of the vessel.

6.2.2. Apply a thin layer of glycerin onto the head O-ring at feed end.

6.2.3. Hold the end cap and the vessel in the same axis and push the end cap into the vessel until some resistance can be felt. Then continue pushing the head slowly into the vessel until it reaches over the groove. Please do not push the head too much over the groove since the seals may be damaged if the head needs to be pulled back. If it is difficult to push the head with hands, a rubber mallet can be used to tap the head until the head reaches its place.

6.3. Install locking kit segment at feed end

6.3.1. Inspect the groove and ensure it is clean and free of residues. Use compressed air to dry the groove if available or use a clean rag to dry it.

6.3.2. Apply lubricant like glycerin onto the locking kit segment screws to prevent salt deposits to buildup.

6.3.3. Install the retaining ring and screws. Tighten the screws up to 10Nm of torque.

6.4. Install the permeate port plug.

Apply Teflon sealing tape on the threads of the plug, not exceeding 2 layers, before threading it into the perm port. Over tightening may damage the permeate port. Maximum torque is 15Nm. Tighten plug at 50% of the maximum torque. The end face of the plug should be 3mm higher than the permeate port face.

Figure 2.21 Install permeate port plug

6.5. Reconnect the pipes

Reconnect the pipes as per **Piping Connections**.

6.6. Check as per Appendix I Pre-Running Check List

Chapter 7 Handling and Storage

Read this article carefully. Incorrect handling and storage may result in catastrophic failure.

Check the packing conditions when accepting the goods. Contact the logistics company at once in case of damaged vessel.

Slight damage in the outer surface of the vessel within the painting layer is acceptable. Any query, please contact ROPV.

7.1. Vessel Handling Precautions

- Keep the vessel from falling down to the ground or colliding with other objects when it is being moved.
- Special care should be taken if forklift or other machinery is used for handling the vessel.
- Use padding to protect the vessels during handling to prevent damage.
- DO NOT Scratch or damage to the inner surface of the vessel.
- DO NOT lift the vessel from the Feed/Concentrate ports or permeate ports.
- DO NOT impose excessive external force on the vessel.
- DO NOT climb on the vessel.
- Damaged vessel must not be used.

7.2. Storage Requirements

- Do not store with other products.
- Make a list of product and spare parts before storage.
- Store vessels in their original packaging.
- Storage temperature range should be -10ºC~+50 ºC
- Storage humidity range should be 40%~70%RH；
- Store in a place with a light intensity of less than 100Lux；
- Store in a safe area to keep the vessel from shaking or falling.
- Height: not exceeding 3 packing units.

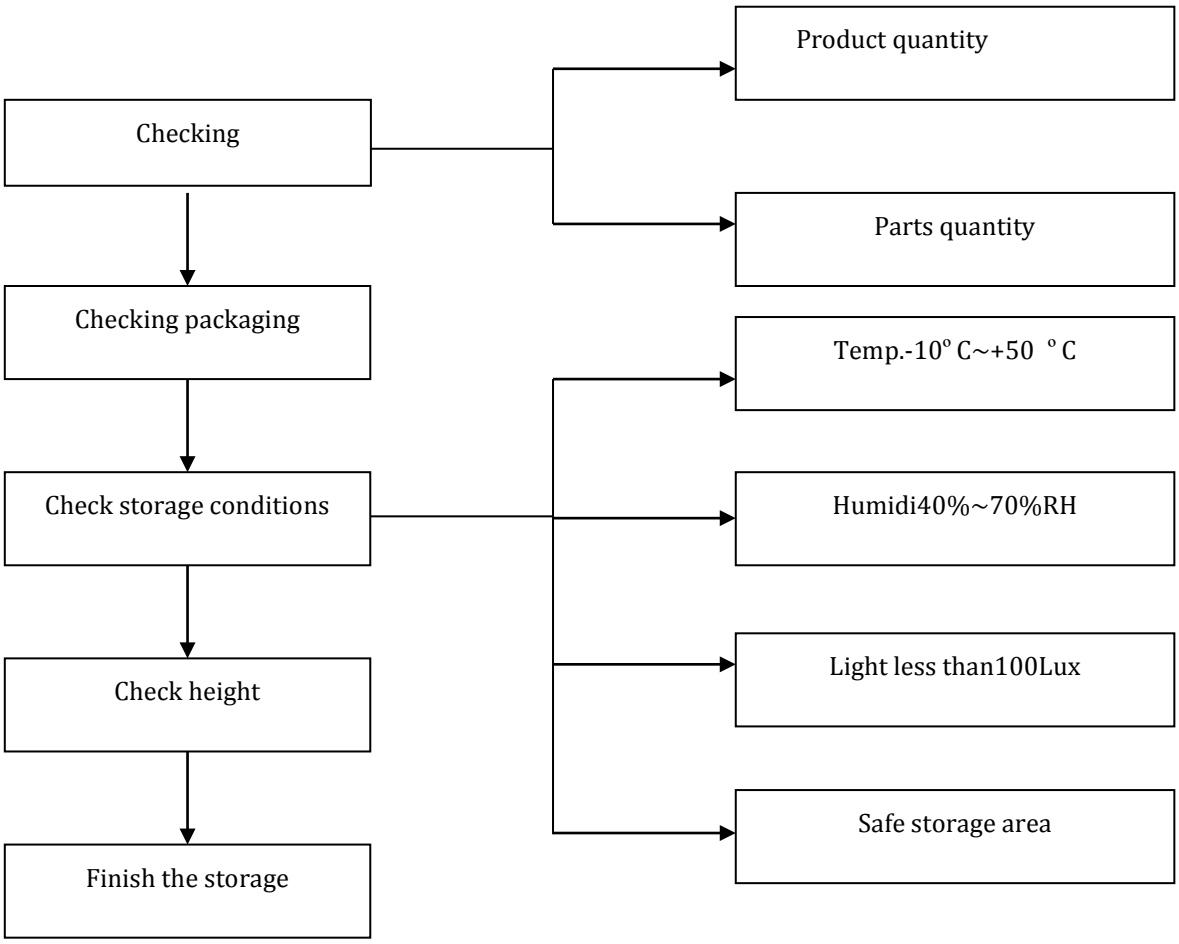


Figure 2.17 Storage procedure

Chapter 8 Breakdowns and Solutions

Please refer to this article for common breakdowns and solutions. The contents of this section need to be used with good practical industrial experience. We recommend that only engineers with extensive work experience conduct any repair work.

8.1. Locking Kit Segment and Related Issues.

8.1.1. Locking kit segment screw is too tight to thread out.

Solution: Apply penetrating fluid (such as WD-40 or LPS-1) onto the locking kit segment and tap it with a hammer until the screw can be threaded off. Please take care not to contaminate the membrane elements.

8.2. Head and Related Issues.

8.2.1. Leakage in seals

Possibilities:

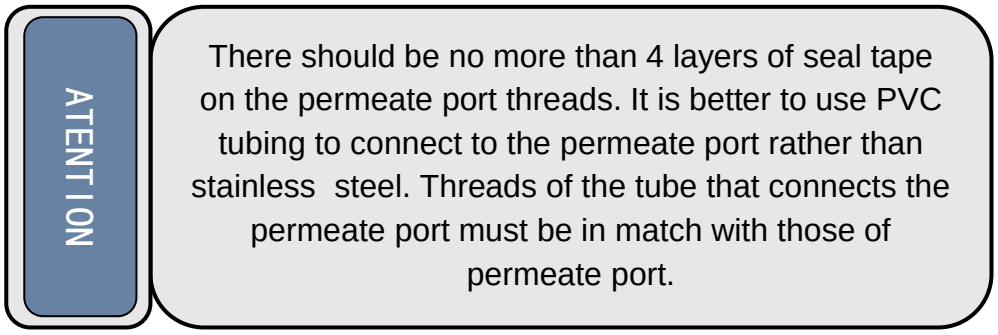
A. Deteriorated head seals after running for over 2 years
B. Seals are damaged due to improper installation
C. Seals are deformed due to the PH of the medium
D. Seals are deformed due to the temperature of the medium

Solution：

a. Check the composition, temperature, and PH of the medium.
b. Replace the seals as per **Maintenance Guide**.

8.2.2. End cap sealing surface or permeate port is damaged.

Solution: Replace sealing plate.


ATENTION
There should be no more than 4 layers of seal tape on the permeate port threads. It is better to use PVC tubing to connect to the permeate port rather than stainless steel. Threads of the tube that connects the permeate port must be in match with those of permeate port.

8.3. Vessel and Related Issues.

8.3.1. Leakage in sealing surfaces.

Possible reasons:

- Scratches or damaged bore at the seal area location.

Solution: For lite scratches, hand sand sealing areas using wet 600grit sand paper until a smooth finish is achieved. For dip damage or scratches not affecting the structural wall (.2mm), epoxy or vinyl ester resin can be used to fill the damaged surface.

8.3.2. Vessel is corroded or cracked

Possible reasons:

A. Ph out of range, medium is to acid or alkaline.
B. Non-acid membrane shells mixed with acid-proof membrane shell.

Solution：

a． Inspect the cracks:

If it is a high pressure vessel or the cracks reach structural layer (.2mm deep), the vessel must be replaced.

b． Check the medium:

Check the PH range and adjust accordingly.

8.3.3. Body damage.

A. During transportation

B. During installation

Solution: replace the vessel if the body is seriously damaged; measures below can be taken if there is only slight damage

Tools: painting gun, air compressor, electric dryer, angel sander and sanding disc, louver blade.

Materials: Epoxy resin and hardener, body filler and hardener, ROPV paint, fiberglass mat.

Steps: First, use epoxy resin, mats, fiberglass mat to fill the damage, once the resin is cured sand the excess until the surface is level and smooth; apply body filler if necessary; last, paint with a painting gun.

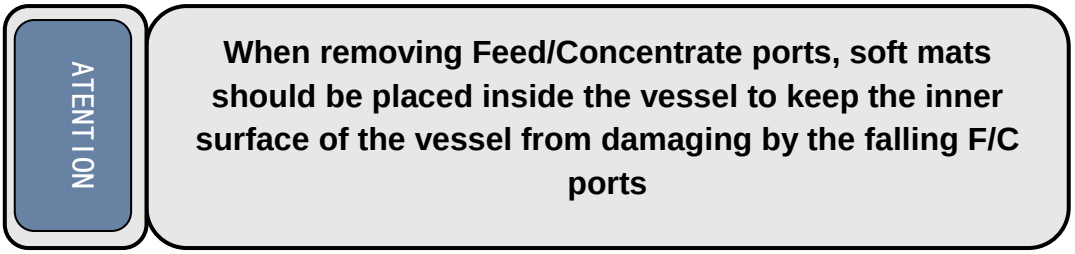
ATENTION

For any leakage of Feed/Concentrate port, please contact Harbin ROPV Industry Development Center

8.4. Feed/Concentrate Side Ports and Related Issues.

Please follow steps below to remove Feed/Concentrate side ports in case of leakage.

A. Shut down the system and drain the vessel.
B. Disconnect the piping off the permeate port and Feed/Concentrate ports.
C. Open the vessel as per **Opening the Vessel**.
D. Remove the retaining ring from the leaking port.
E. Using a rubber mallet, tap the port in wards to remove the port.


ATENTION
When removing Feed/Concentrate ports, soft mats should be placed inside the vessel to keep the inner surface of the vessel from damaging by the falling F/C ports

Possible reasons:

1. Seals are damaged

Solution: replace the seals

2. Ports are corroded or damaged or the sealing groove is scratched.

Solution: replace the Feed/Concentrate ports

3. Ports and the manifolds are not in the same axis (misaligned)

Solution: adjust the manifolds and reconnect the pipes as per **Piping Connections.**

8.4.1. Feed/Concentrate Side Port Inspection and Installation.

Please follow steps below to install Feed/Concentrate side ports

A. Clean ports- Remove the fouling or residue on the F/C ports with a mild soap solution and flush them with clean water. Dry them with compressed air if available or a clean towel.

B. Lubricate and install F/C ports seals- apply a thin layer of glycerin onto the seals and seat them into the grooves in the F/C ports

C. Apply a thin layer of glycerin onto the inner side surface of the vessel's ports. Insert the F/C ports into the hole in the vessel from the inside the vessel and push them out until the retaining ring grooves are visible from the outside of the vessel.

ATTN

Do not to scratch the inner surface of the vessel's side holes when installing F/C ports.

D. Install the retaining rings

E. Reconnect the pipes as per **Piping Connections**.

8.5. Low Permeate Water Quality

Possible reasons:

A. O-ring seals are damaged due to displaced membrane elements caused by frequent starting and shutting down of the system without taking measures to ensure gradual pressure increase when starting and gradual pressure release when shutting down.

Solution：

a. Remove the head as per **Opening the Vessel** and remove the adaptor.

b. Replace the permeate port seals and adaptor seals.

c. Close the vessel as per **Loading/Replacing Membrane Elements** and **Closing the vessel**.

B. Membranes may be displaced out of the sealing area during starting and shutting down the system.

Solution: Shimming the membranes.

a. Remove the head at feed end and adaptor as per **Opening the vessel**.

b. Remove the adaptor seals and the head O-ring. Insert the straight end of the adaptor into the permeate hub far enough to be held by the adaptor sea. Align the adaptor with the membrane and push the head carefully into the vessel until the groove is exposed far enough to insert a locking segment into it. Slowly remove the head with care and then check the size of the gap between permeate port and adaptor. The number of 2mm shims needed to fill this gap will depend on the size of the gap. Reinstall the adaptor seals and seal plate seal; slide shims on the flat end of the adaptor and insert the adaptor into the permeate port hub. Shims must be placed between the permeate port and adaptor.

c. Close the vessel as per **Closing the Vessel.**

Chapter 9 Service guide

Dear users：

Thanks for choosing ROPV FRP pressure vessels. We provide you with the following services according to our national laws and regulations (See ROPV Limited Warranty for more details):

I. Quality warranty

ROPV promises to provide “one-year warranty and lifetime maintenance” on the condition that the vessels are properly installed and operated.

II. Technical suppport

1. ROPV commits to reply users within 8 hours for their complain or technical consultation.
2. ROPV commits to arrive at project site within 48 hours if needed.

III. Exclussions for the free service coverage

1. Damages caused by improper transportation, installation, operation and maintenance
2. Damages caused by operation without sticking to the requirements in this manual
3. Invoices are altered or Inspection Certificate is not available

TIP:

Any problem, please contact via after-sales hotline 0451-82267309

Phone： 0451-82267301/02/06/08

E-mail: service@ropv.com.cn

Website： www.ropv.com.cn

Appendix I

Pre- Running Check List

Name		Drawing No.	
Pressure rating		Vessel No.	

Items		Status
Membrane elements	Membrane is loaded as per requirements	YES□ NO□
	Adaptor is installed as per requirements	YES□ NO□
	Thrust ring is installed as per requirements	YES□ NO□
Vessel	All components are clean and in good conditions	YES□ NO□
	Vessel is installed and fixed as per requirements	YES□ NO□
	Head is assembled as per requirements	YES□ NO□
	Locking kit segment and securing ring (high pressure vessels) are installed as per requirements	YES□ NO□
	The pressure gage of closed vessel reads the same as that of the system	YES□ NO□
Piping connections	Pipes are connected as per requirements without stress concentration	YES□ NO□
	All piping components are in good conditions	YES□ NO□

Installation staff:_____ Installation date:_____

Inspector:_____ Inspection date:_____

Appendix II

Maintenance Check List

Name		Vessel No.	
Pressure rating		Work pressure	
Running time		Times of maintenance	
Item	Status	Treatment	
Corrosion	YES□ NO□		
Deterioration	YES□ NO□		
Damage	YES□ NO□		
Leakage	YES□ NO□		

Inspector：_____ Inspection date：_____

Maintenance staff：_____ Maintenance date：_____

ROPV Limited Warranty

Harbin ROPV Industry Development Center (hereinafter called "ROPV") vessels (the "Product") are warranted to the original purchaser (the "Customer") under normal use and if installed, operated and maintained in accordance with applicable User Guides to be free of defects in material and/or workmanship for a period of one (1) year from date of manufacture subject to the following. Any replacement Product or Part will be warranted only for the remainder of the original warranty period or thirty (30) days, whichever is longer.

Exclusions from this Limited Warranty

The warranty shall be void if:

1. Defects are not reported during the warranty period.
2. The Product is subject to accident, damage, incorrect installation, mishandling, abuse, misuse, negligence or accident by any other party.
3. Problems caused by modification or alteration.
4. Chemical exposure or acts of nature.
5. Any item manufactured by other companies.
6. Wear on replaceable components under normal conditions – seals are excluded from this warranty.

Procedure for Obtaining Warranty Performance

ROPV reserves the right to determine if a reported defect is a breach of this warranty. This may require, at ROPV's discretion, one or more of the following: 1. an inspection or test of the Product and/or the system in which it was installed by an ROPV representative - the customer is responsible for arranging access to the Product. 2. an inspection or test of the product and/or the system in which it was installed by the Customer. 3. an inspection or test of the product and/or the system in which it was installed by third party inspector appointed by ROPV. 4. return of the Product to ROPV's factory for inspection or testing. This is not a statement of limitations for warranty performance and ROPV reserves the right to conduct warranty performance outside of the items shown.

If the Product is found by ROPV to be defective under the terms of this warranty, ROPV will perform one of the following at its option: 1. supply a substantially similar replacement part based on FOB factory terms. 2. conduct a field repair of the Product. 3. issue a credit for the original cost of the Products. This is not a statement of limitations for warranty performance and ROPV reserves the right to conduct warranty performance outside of the items shown.

Products returned to ROPV for inspection or testing must be shipped freight prepaid at the Customer's expense. If a breach of warranty is confirmed, ROPV will bear all costs related to the inspection and testing. If the Product failure is found to be caused by cause other than breach of warranty, all costs related to the inspection and testing of the Product will be borne by the Customer. This includes a USD$500 per day fee and all related travel expenses.

All reported defects must be submitted to ROPV in writing.

Disclaimer

ROPV makes no expressed or implied warranty other than that specifically set forth in this warranty statement. ROPV disclaims any warranty of merchantability or of fitness for a particular purpose.

ROPV's liability under the terms of this warranty shall not exceed the purchase price of the Product which are claimed to be defective. ROPV shall not be liable for any consequential or incidental damages whatsoever, including but not limited to injuries or damages to person or property, loss of business profits, business interruption, loss of use, cost of removing/installing Products, or the claims of third parties.

Warranties or Representations by Others

No agent, employee, dealer, or other person has any authority to make any warranties or representations concerning ROPV or the Product. ROPV is not responsible for such claims of warranty or representation.